Extreme Habitats II: **Pelagic Fishes**

FISH 310

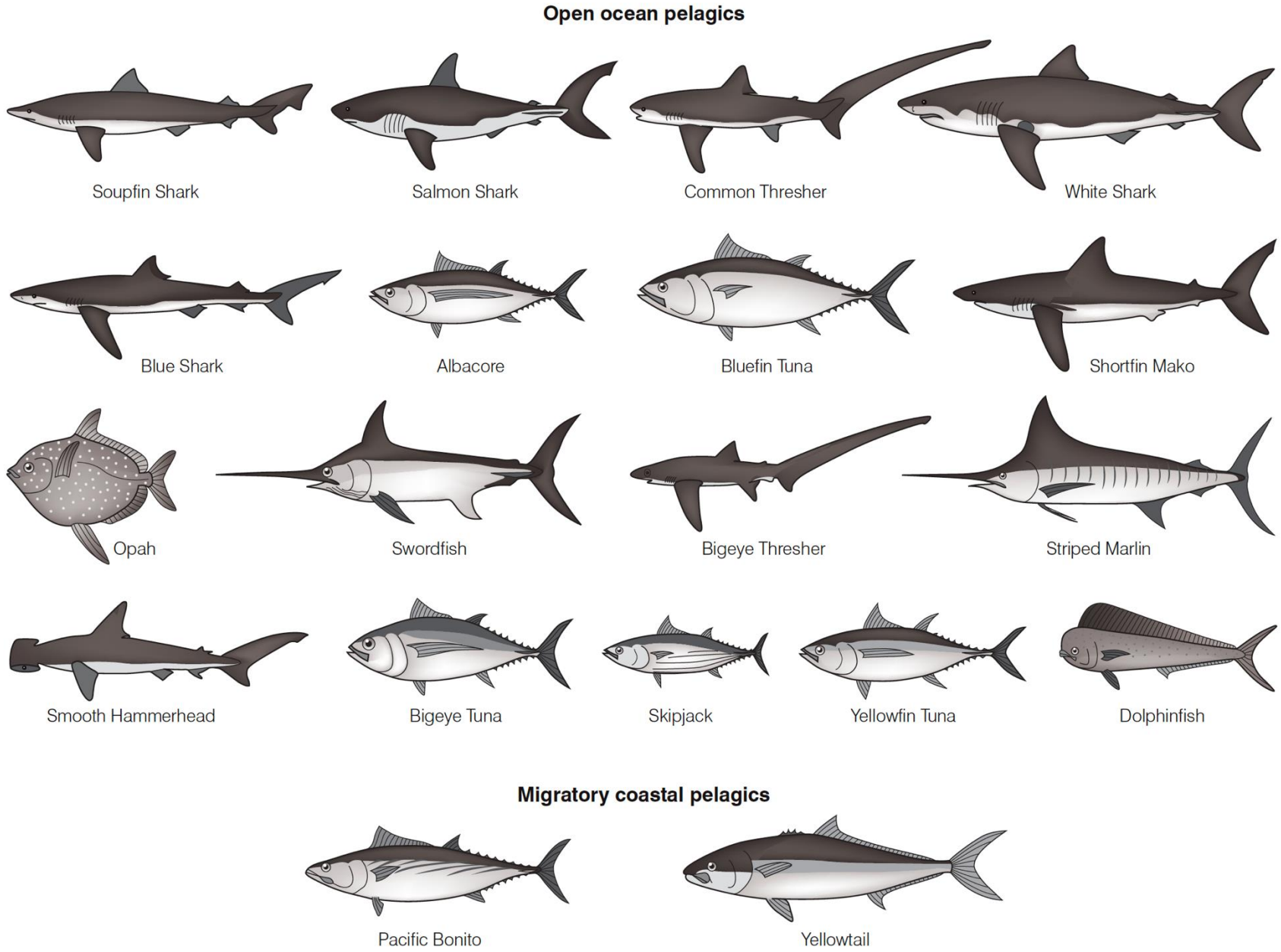


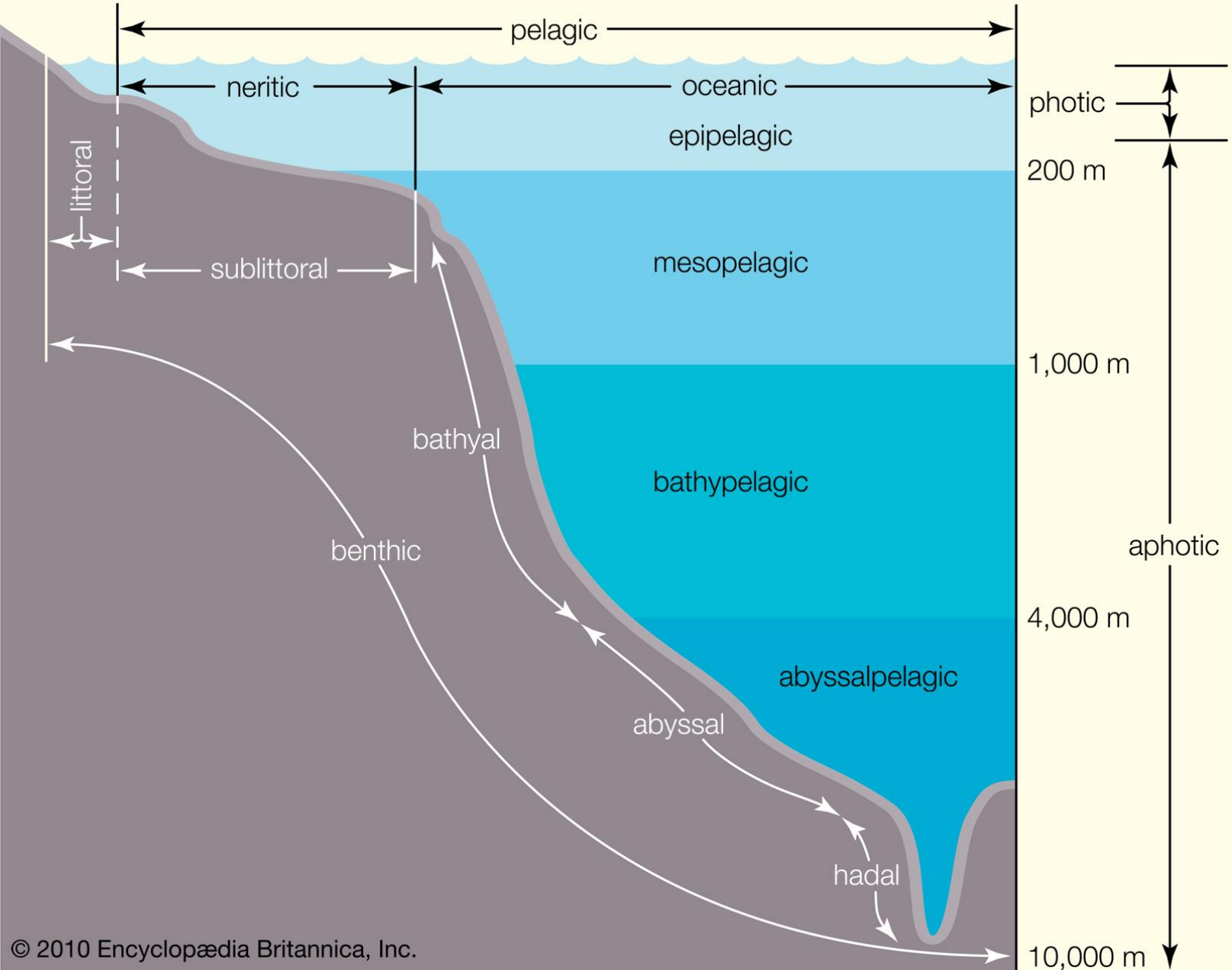
Figure 18.6

Open ocean and migratory coastal pelagic species of the California coast. Many of the open ocean species occur worldwide in temperate and especially tropical oceans. After Allen and Pondella (2006).

Today's Roadmap

- **Abiotic factors of the pelagic realm**
- **Economic importance of pelagic fishes**
- Adaptations and superlatives of pelagic fishes
- Flotsam: Providing structure in the open sea
- Life history of pelagic fishes
- Convergent evolution in limnetic fishes

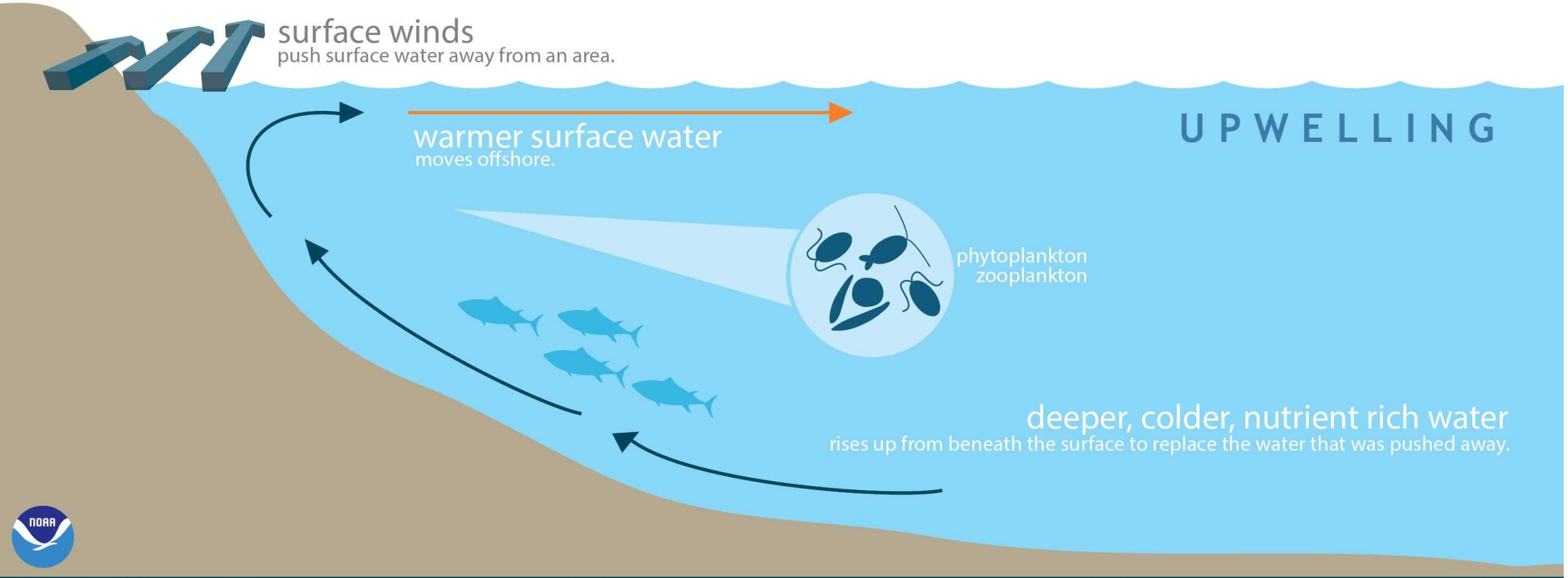
Abiotic characteristics of pelagic waters



- High solar insolation (sun exposure)
- Variable production (may be very high in regions of upwelling or convergence of major currents)
- Large volume
- Lack of physical structure

Economic importance of pelagic fishes

- Pelagic fishes = nearly half of the fish captured annually worldwide (by weight)
- Largest fisheries in areas of **upwelling**
  - May account for 70% of the world fisheries catch (Cushing 1975)


surface winds
push surface water away from an area.
warmer surface water
moves offshore.
UPWELLING
phytoplankton
zooplankton
deeper, colder, nutrient rich water
rises up from beneath the surface to replace the water that was pushed away.

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Common adaptations of pelagic fishes

schooling

streamlined with forked or lunate tails

Sardinops sagax

Common adaptations of pelagic fishes

generally migratory

account for all known fish examples of endothermy

Opah *(Lampris)*

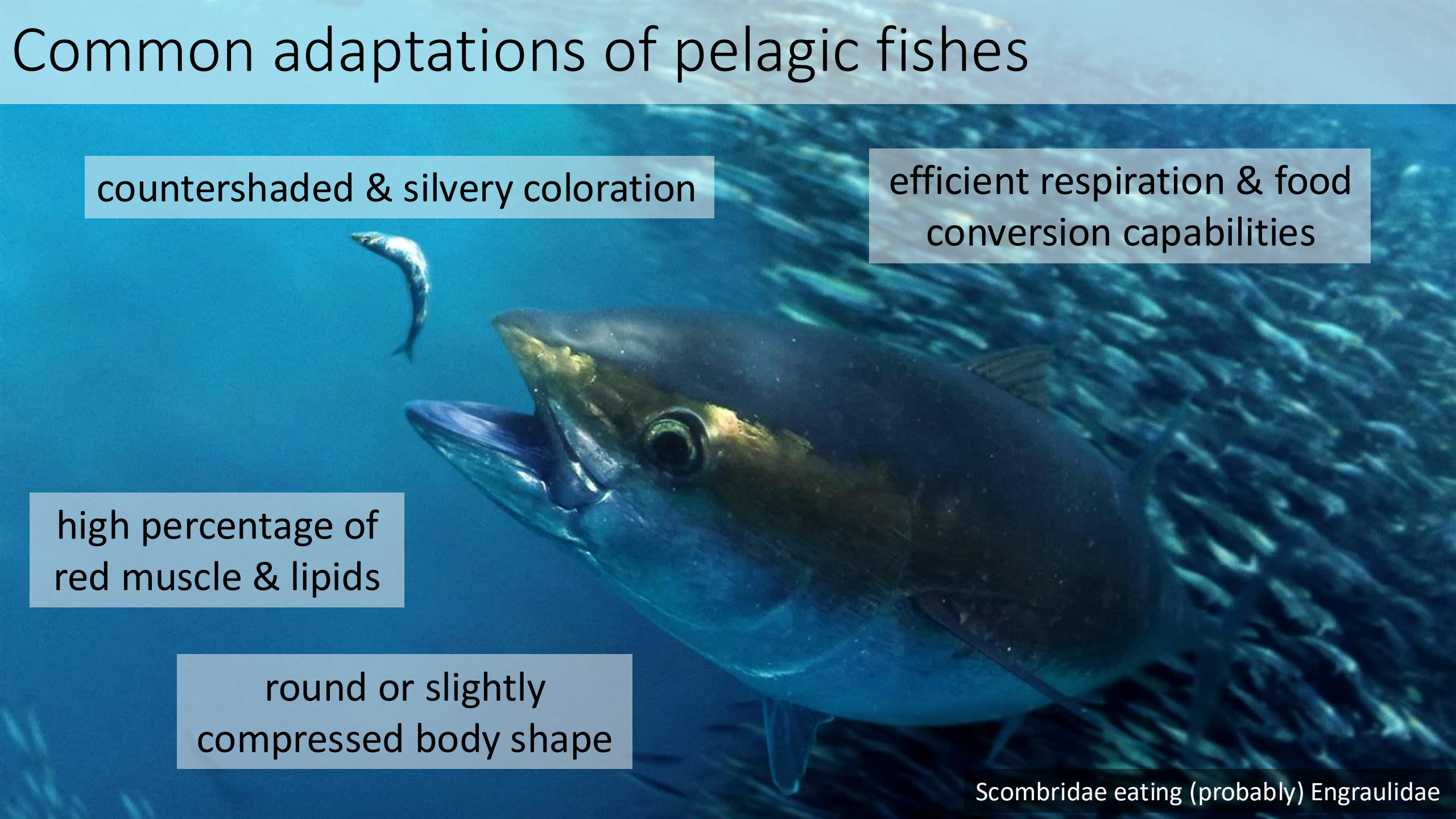
Common adaptations of pelagic fishes

countershaded & silvery coloration

efficient respiration & food conversion capabilities

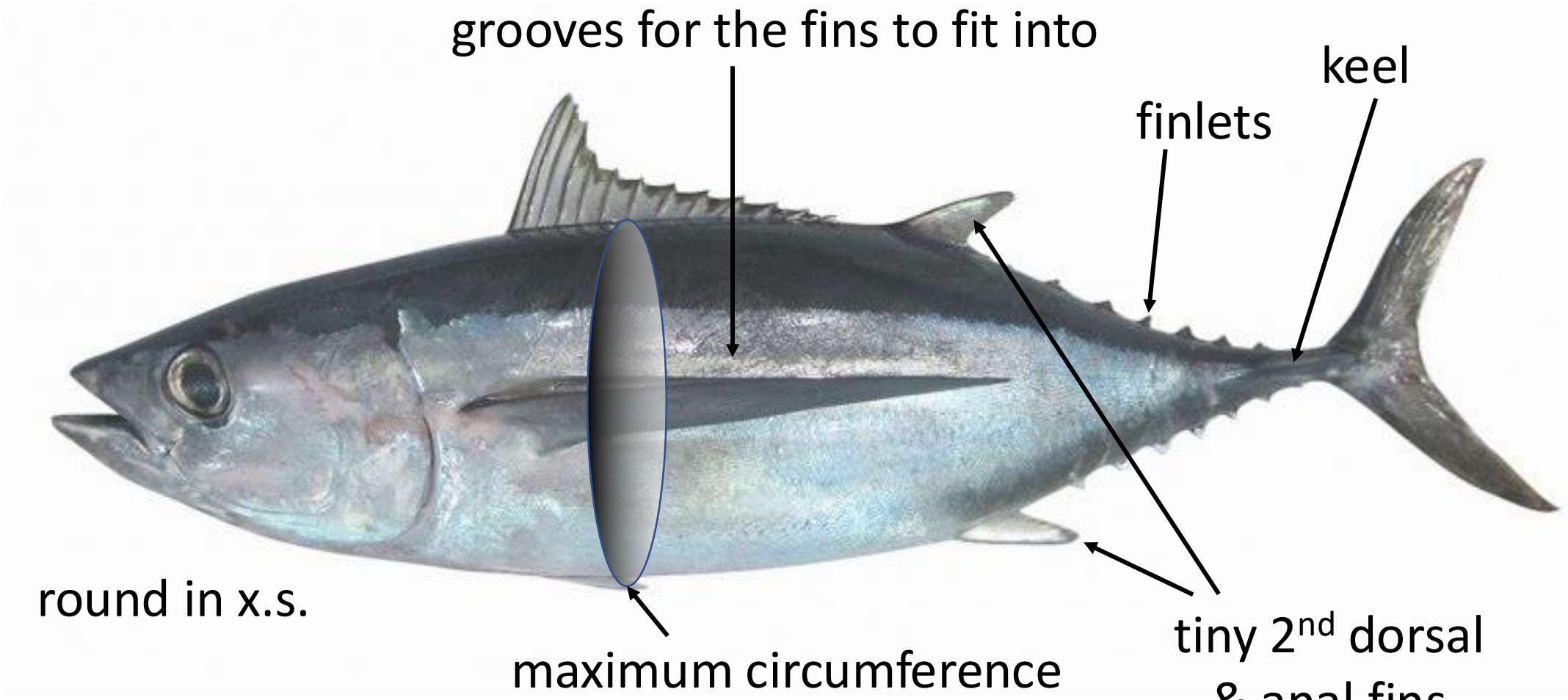
high percentage of red muscle & lipids

round or slightly compressed body shape



Scombridae eating (probably) Engraulidae

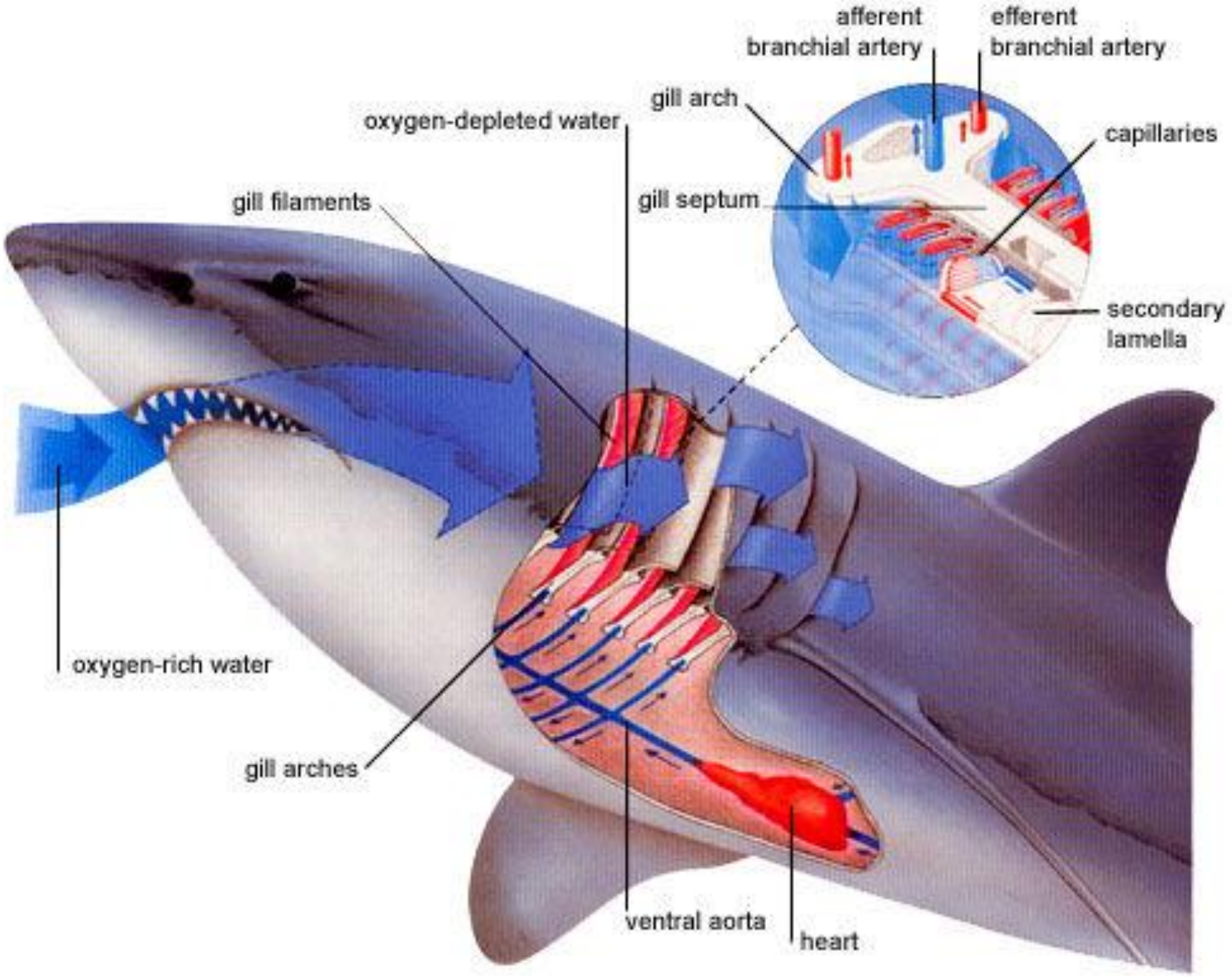
Streamlined body shape



Ram Ventilation

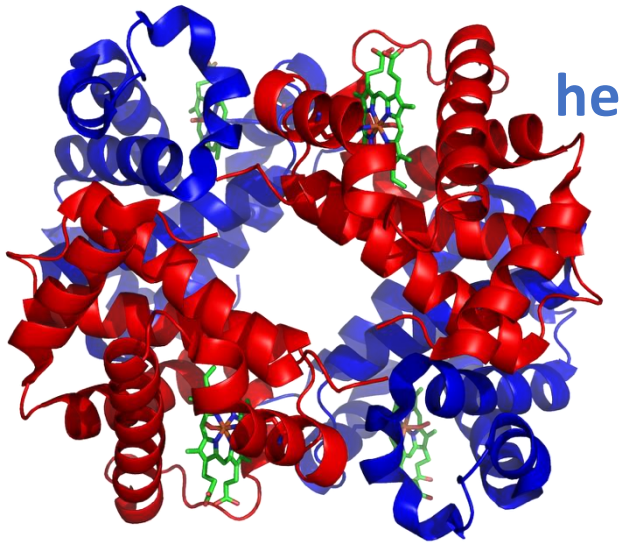
Requires continual swimming at speeds of at least 65 cm/s (~1.5 mph), easily attained by any but the smallest tunas at their cruising speed of 1 body length/s

**Buccal pumping = 15% total energy expenditure for a fish!*



Efficient respiration & circulation

- Enhanced ability to supply O2 to muscles
  - Higher hemoglobin concentration (menhadens, bluefish, tunas)
  - Large hearts (tunas) & large blood volumes
  - Thin lamellar walls of the gills & increased number of gill lamellae (herrings & mackerels)



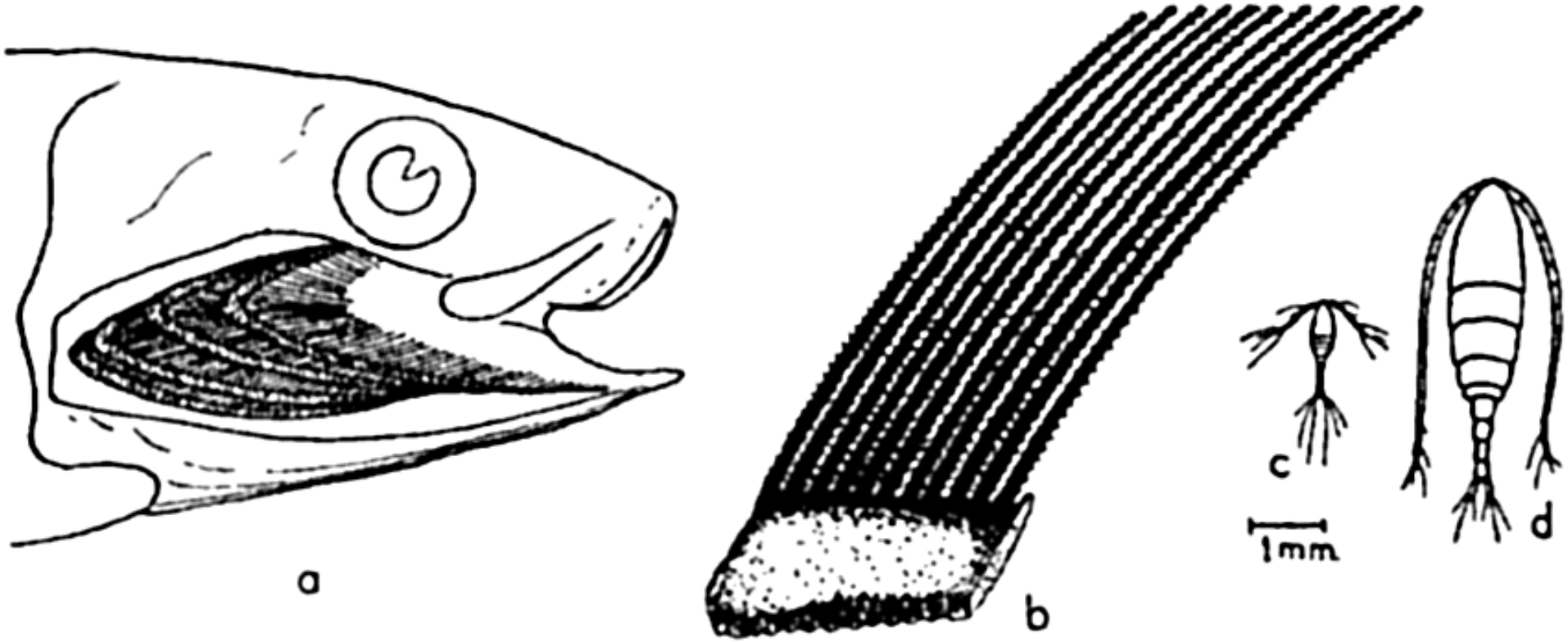
hemoglobin molecule

tuna gills

(these ones producing excess mucus, due to an infection)

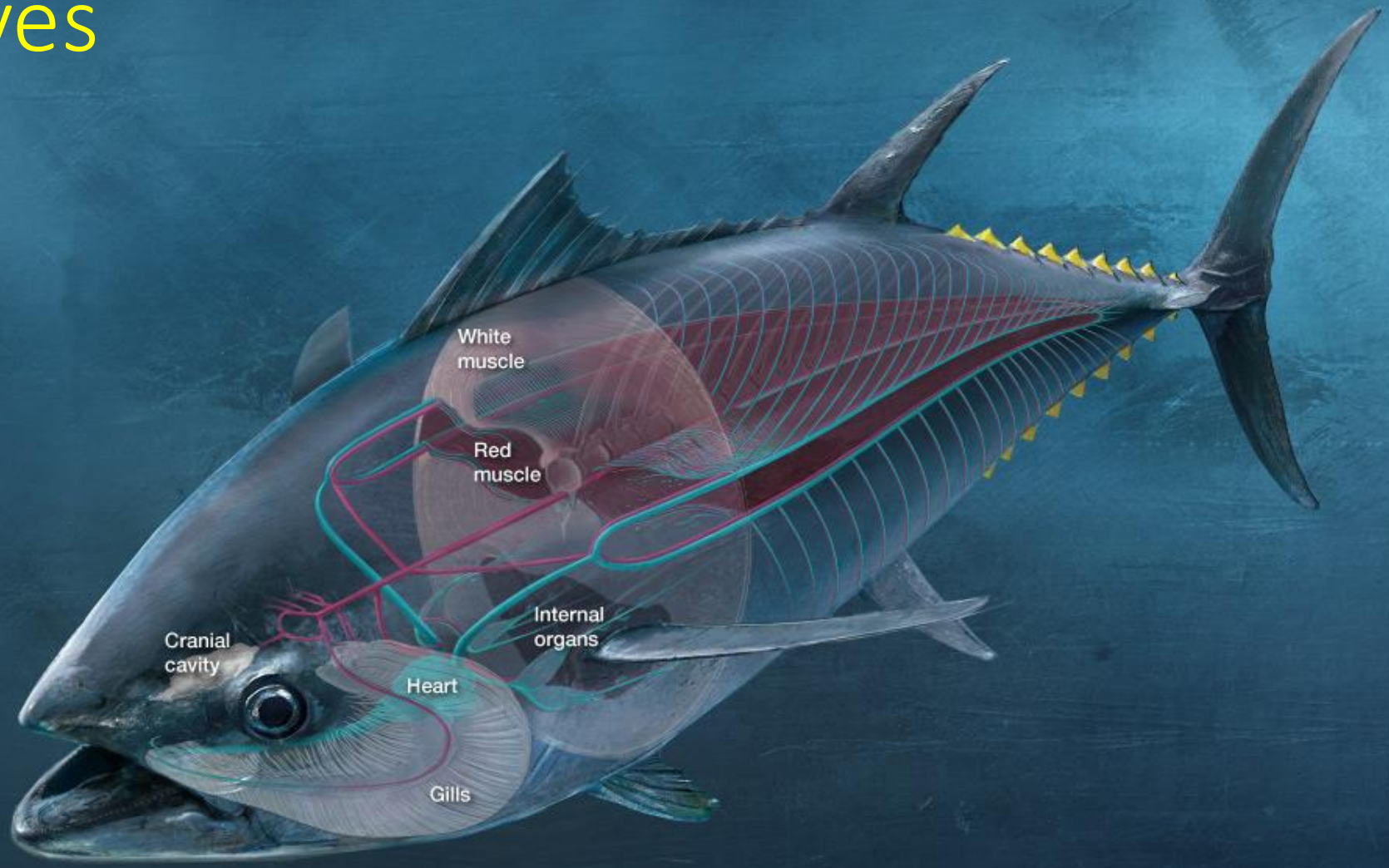
Pelagic feeding: plankton & piscivory

- Filter feeding enhanced by anatomical modifications
- Zooplankton abundance = ~25 ppb in the Central Pacific
- Predatory fish are nomadic to take advantage of patchy resources



Pelagic superlatives

- **Longest migrations:** 1000s of km annually for large sharks, salmon, tunas, and billfishes
- Correspondingly **highest proportion** of **red muscle**
- **Heat conservation strategies**



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Flotsam

- Almost always has fishes associated with it
- Some juveniles, some flotsam specialists

Spotted driftfish (*Ariomma regulus*)

Sargassumfish (*Histrio histrio*)

Flotsam

- Attracts predators like billfishes, dolphinfishes, and sharks

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Two general patterns of pelagic life history:

1. **Cyclonic** (high latitudes)
   - Larvae live in diff. part of the ocean
   - Adults have seasonal feeding area, return to upcurrent spawning area w/abundant food resources every year
   - Larvae or juveniles drift to the adult feeding region
   - Large energy investiture, variable spawning success → fluctuations in year class strength
2. **Anticyclonic** (low latitudes)
   - Adults move in annual loop through ocean basin, repeated spawning
   - Larvae & juveniles carried along w/adults
   - Energy spread out over multiple episodes, environmental cues determine appropriateness of spawning conditions → weaker fluctuations in year class strength; shorter lifespan, quicker time to maturity

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Limnetic fishes

- Open water fauna of lakes have similar traits to pelagic fishes:
  - Upturned mouths
  - Silvery color
  - Forked tails
  - Compressed bodies
  - Schooling
  - High lipid content
  - Planktivory

Goldeye (*Hiodon alosoides*)

Common Rudd (*Scardinius erythrophthalmus*)

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Pleuragramma antarcticum

"Is that kind of a sad fish?" - Mihai

- Same adaptations seen in pelagic notothenioid adults and pelagic larvae of benthic notothenioids